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ABSTRACT

This Teacher Education and Mathematics (TEAM) module is designed to increase students': (1) awareness of the existence of sex bias in curriculum materials and in classroom practices; (2) skill in identifying sex-role stereotypes in materials and practices; and (3) skill in counteracting sex bias in instructional materials and practices. It consists of an instructor's text and student materials. The instructor's text provides specific directions for guiding the lessons and commentary designed to help teachers build positive mathematics attitudes. The format is one of "facing pages" whereby the right-hand page provides step-by-step teaching directives and the left-hand page provides teaching insights, other options of instruction, and psychological or attitudinal strategies, when appropriate. Space for the instructor to add notes about a particular point in the lesson or about teaching experiences with the class (for future reference and use) is also provided on the left-hand page. When there is no commentary applicable to the points in the lesson, the entire left-hand page has been alloted to "notes." Student materials include various worksheets, assignments, and readings which focus on such areas as views of females and males in mathematics curriculum materials and the content analysis of mathematics textbooks. (JN)

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Sex-Role Stereotyping in Mathematics Education

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A Course to Reduce Math Anxiety and Sex-Role Stereotyping in Elementary Education

TEAM

TEACHER EDUCATION AND MATHEMATICS

Queens College of the City University of New York
Women's Educational Equity Act Program/U.S. Department of Education

SE 045 894

TEACHER EDUCATION AND MATHEMATICS

A Course to Reduce
Math Anxiety and Sex-Role Stereotyping
in Elementary Education

SEX-ROLE STEREOTYPING IN MATHEMATICS EDUCATION

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CONTENTS

I. INSTRUCTOR'S TEXT I

Introduction I-3

Overview I-5

Beginning the Program I-7

Content Analysis of Math Materials I-9

Classroom Practices I-11

II. STUDENT MATERIALS II

"Teachers and Sex Bias in Mathematics," by Elizabeth Fennema II-3

"Sex Roles in Mathematics: A Study of the Status of Sex Stereotypes in Elementary Mathematics Texts," by Henry S. Kepner, Jr. and Lilane R. Koehn II-8

"Update on Sex-Role Stereotyping in Elementary Mathematics Textbooks," by Helen F. Kuhnke II-17

"Sex Stereotypes in Mathematics and Science Textbooks for Elementary and Junior High Schools," by Josephine Mlinar II-22

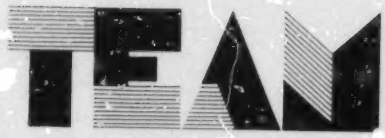
"Sexual Stereotyping in Mathematics: Beyond Textbooks," by Laurie H. Reyes II-27

Views of Females and Males in Mathematics Curriculum Materials II-29

Content Analysis: Mathematics Texts II-30

Classroom Tasks and Activities II-31

"Teachers Are Important," Script by Sheila Crowell, Elenor Rubin Denker, and Ellen Kolba II-32



SEX-ROLE STEREOTYPING IN MATHEMATICS EDUCATION

I

INSTRUCTOR'S TEXT

INTRODUCTION

The Sex-Role Stereotyping in Mathematics Education module was designed for use in a course or workshop series concerned with mathematics and women's issues. It consists of an Instructor's Text and Student Materials. Both parts of the module are designed for use in a loose-leaf notebook.

The Instructor's Text indicates specific steps the instructor can take to build lessons that make students aware of the nature and extent of sex bias in curriculum materials. This is accomplished by a "facing pages" format. The right-hand page contains directive text that indicates how the instructor may proceed, step by step, in presenting the lesson. The left-hand page, "Commentary and Notes," provides teaching insights, other options of instruction, and psychological or attitudinal strategies, when appropriate. Space for the instructor to add her or his own notes about a particular point in the lesson or about teaching experiences with the class (for future reference and use) is also provided on the left-hand page. When there is no commentary applicable to the points in the lesson, the entire left-hand page has been allotted to "Notes."

Student Materials includes worksheets, assignments, and readings.

NOTES

OVERVIEW

The purposes of this module are to increase (1) students' awareness of the existence of sex bias in curriculum materials and in classroom practices, (2) students' skill in identifying sex-role stereotypes in materials and practices, and (3) students' skill in counteracting sex bias in instructional materials and practices.

A variety of learning activities has been included which provides for whole-class, small-group, and individual participation.

COMMENTARY AND NOTES

This slide-tape show is available from:

Feminist Press
Box 334
Old Westbury, New York 11568

Purchase price: $300.

Alternative ways of introducing the topic can be through the instructor's presentation of materials on sex bias, through readings, through discussion of personal experiences, or through review of textbooks and workbooks.

Expect that many feelings associated with past experiences may be touched. Students may express widely differing reactions, some feeling that they had, and others that they had not, personally experienced sex bias.

These articles are included in Student Materials.

Feelings of the need for fairness to males may be expressed. Don't be surprised if students feel strongly and take strong positions.

BEGINNING THE PROGRAM

Introduce students to the presence of sex bias through the use of a slide-tape show that has demonstrated impact on knowledge and attitudes.

Images of Males and Females in Elementary School Textbooks in Five Subject Areas

This presentation, by Lenore J. Weitzman and Diane Rizzo, provides detailed data based on content analyses of the most widely used textbooks in science, mathematics, reading, spelling, and social studies. For many people its description of the latent content of textbooks is a revelation. Approximately 45 minutes should be scheduled for viewing the program, which consists of three slide carousels and an audiotape. Time for discussion should be provided, since the materials tend to arouse feelings and to provoke questions and ideas.

Ask: "How did you feel about this information? Have you thought about these sex equity issues before? Were you encouraged to do nonstereotyped things by teachers? How were stereotyped conceptions of sex roles fostered, in your experience?"

Provide students with additional information by assigning some or all of the following:

1. Fennema, E. "Teachers and Sex Bias in Mathematics." Mathematics Teacher 73 (March 1980): 169-73.

2. Kepner, H. S., Jr., and L. R. Koehn. "Sex Roles in Mathematics: A Study of the Status of Sex Stereotypes in Elementary Mathematics Texts." The Arithmetic Teacher 24 (May 1977): 379-85.

3. Kuhnke, H. F. "Update on Sex-Role Stereotyping in Elementary Mathematics Textbooks." The Arithmetic Teacher 24 (May 1977): 373-76.

4. Mlinar, J. "Sex Stereotypes in Mathematics and Science Textbooks for Elementary and Junior High Schools." In Report on Sex Bias in the Public Schools. New York: Education Committee, National Organization for Women, New York City Chapter, 1973.

5. Reyes, L. H. "Sexual Stereotyping in Mathematics: Beyond Textbooks." The Arithmetic Teacher 26 (April 1979): 25-26.

Allow sufficient time for students to discuss their reactions to the ideas they have read.

Ask: "What surprised you most in the article(s) you read? What have you noticed in your readings from other sources? How did these ideas feel to you as you read them? Has it seemed to you that the women were wearing aprons, baking cookies, and ironing, whereas the boys were getting to do all the things that sounded adventurous?"

COMMENTARY AND NOTES

Textbooks can often be found in the children's section of the library if a curriculum materials center isn't available. Recently published texts should be included in the supply, along with some from the late 1960s and early 1970s.

Note the nature and extent of students' participation in this activity. Some students are uncomfortable with the idea of sex bias and find it very difficult to detect any instances of bias. It is helpful to the student to feel accepted, even though the instructor points out many instances of bias that individual students didn't see.

CONTENT ANALYSIS OF MATH MATERIALS

Have students read "Views of Females and Males in Mathematics Curriculum Materials" in their Student Materials, page II-29. Ask the students to evaluate these materials for sex bias.

After a brief discussion of their reactions, show students how observations can be formalized by means of guidelines, such as those in the Student Materials section under "Content Analysis: Mathematics Texts," page II-30.

Check on students' understanding of what each category means by having them generate examples drawn from their reading or experiences (e.g., "This book shows women in 'female' occupations, such as secretary or nurse, and men in 'male' occupations, such as engineer or scientist or police officer").

Organize the students in pairs and have each pair, using the guidelines, analyze a randomly selected section (10 to 12 pages, for example) of an elementary school mathematics text. Students can share their findings in a class discussion or in discussion groups of eight to ten students.

Elicit students' responses to the materials they are using. Encourage students to express their feelings. Help keep the discussion moving by asking questions such as "How do others feel about this point?" and "Does this experience seem similar to (or different from) your own?" Summarize ideas to emphasize key points.

CLASSROOM PRACTICES

Introduce this segment of the module by having students read to themselves or perform the script "Teachers Are Important," which is found in Student Materials, page II-32. Allow about 20 minutes for reading; if acted, probably half an hour will be required.

Invite students' reactions to the reading or performance. Ask, "How did you feel about Millie's problem in teaching math? Did you have other ideas about how Millie could have handled her problem? What interested you most (least) about the problem presented? How did you feel about Sue's interaction with Millie?"

Direct students' attention to "Classroom Tasks and Activities" in Student Materials, part II, page 31. Have students examine and analyze the list for the presence of bias. Discuss their judgments about the sample presented. Ask for comments drawn from their experiences.

Ask: "In what ways can teachers counteract the effects of sex-role stereotyping in curriculum materials and in classroom practices?" Make a list of those suggestions for students to keep as a resource. The list might include items like the following:

1. Point out to students ways in which girls and boys (women and men) are portrayed in textbooks.

2. Rewrite math problems (for children and/or with children) to provide nonstereotyped portrayals of males and females.

3. Have students point out instances of stereotyping they find in books they use.

4. Be conscious of the ways in which you, as the teacher, assign tasks in the classroom. Give assignments on a sex-neutral basis.

5. Provide materials to supplement classroom resources that describe girls (women) as successful and competent in a wide variety of activities.

6. Volunteer to be on the committee of teachers who will recommend texts to be bought. Check to be sure that sex-neutral materials are recommended for purchase.

SEX-ROLE STEREOTYPING IN MATHEMATICS EDUCATION

II

STUDENT MATERIALS

TEACHERS AND SEX BIAS IN MATHEMATICS

A look at some ways that teachers can improve the mathematics education of girls, as well as that of boys.

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Teachers are important! They make a major impact on students' feelings about mathematics as well as on their learning of mathematics. Although other people such as counselors and parents also have an effect, it is the day-by-day interaction with teachers that is the most powerful influence on students. Students' feelings about themselves as learners of mathematics, their perception of the usefulness of mathematics, and their willingness to continue the study of mathematics beyond minimum requirements are all directly influenced by teachers.

Unfortunately, there is much evidence to indicate that teachers are differentially influencing females and males in their learnings and feelings toward mathematics. Partly as a result of this differential treatment, females, to a much greater extent than males, are receiving inadequate mathematical education in high schools. This inadequate education was demonstrated by the results of the first National Assessment of Educational Progress (NAEP), where the superiority of adult males clearly appeared. In addition to data from NAEP, the predominance of males in all mathematics-related careers for which women lack mathematical skills, has been attested to by many authors. Although the reasons for this domination can be traced to many causes, a major reason is that many, if not most, women are inadequately prepared in mathematics. Without adequate mathematical training, women will never achieve equity with men in the world of work. Mathematics is truly the critical filter that keeps women, as well as some men, from many desirable professions and vocations.

What do teachers do that differentially influences males and females in their learning and feelings about mathematics? In many subtle ways, teachers treat females differently than they do males, and this differential treatment is a negative influence on females' studying of mathematics. From the first grade throughout high school, teachers pay more attention to males than to females (Schonborn, 1975). Not only do males receive more discipline or blame from teachers, they also receive more praise from teachers. In high school mathematics classes, high-achieving boys receive significantly more attention from teachers than do high-achieving girls (Brophy and Good, 1970). And this is true not only for male mathematics teachers but for female mathematics teachers as well. As teachers are spending more time with males, not only are they helping males more, but also they are communicating, albeit subtly, that males' concerns in mathematics are more important than females' concerns and that mathematics learning is more essential for males than for females.

> Females are receiving inadequate mathematical education in high schools.

Not only do mathematics teachers interact more with males than they do with females, they also reinforce or reward males and females for different types of behavior. Males are rewarded for behavior stereo-

March 1980

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typed as male, and females are rewarded for behavior stereotyped as female. It appears that in mathematics, computational behavior is rewarded in females, and higher level cognitive skills, such as problem solving, are rewarded in males (Fennema, 1977). What is rewarded is usually what is learned—and there is a tendency for females to be better at computational tasks and males at higher level cognitive skills (Fennema, 1977). As one advances in the study of mathematics, these higher level cognitive skills become increasingly important, and mathematics becomes increasingly incongruent with the female stereotype.

> Mathematics is the critical filter to many desirable jobs.

Mathematics teachers are less concerned about providing remedial help to females than they are to males (Gregory, 1977). Males are much more apt to be referred to remedial clinics for assistance than are females, even when the achievement levels of the girls and boys are similar.

Teachers have different perceptions of males and females as learners of mathematics, and these perceptions are often inaccurate. In a recent survey, information about attitudes toward females, males, and mathematics was gathered from fifty-two male and twenty-four female mathematics teachers in ten midwestern high schools. Two attitudes that appear to be strong influences in females electing to study mathematics were selected for study: perceived usefulness of mathematics and anxiety about learning mathematics (Fennema, 1977). Information about the same attitudes toward mathematics was also collected from 1200 ninth- and tenth-grade mathematics students in the same schools. Although the female students indicated that they had significantly higher levels of anxiety toward mathematics than did the male students, the teachers perceived the males to be more anxious than the females. Male students thought that mathematics was more personally useful than did the female students. Once again, the mathematics teachers' perception was different than the students'. The teachers thought that mathematics was potentially more useful to their female students than to male students.

One can only speculate why the teachers' perceptions differed so much from the students' feelings. The teachers might have answered the questions the way they thought was most socially desirable. On the other hand, it is difficult to see why it would be believed that it is socially desirable for males to be more anxious about mathematics than females. A more reasonable explanation appears to be that the teachers are inaccurate in their perceptions of girls' feelings toward mathematics. These inaccurate perceptions are caused, at least partly, from the stereotypic belief that math is a male domain and that it is highly essential that males learn it. Teachers might be more anxious about males learning mathematics and, as a result, feel that the boys themselves are more anxious.

No matter what the explanation of the teachers' responses is, it is clear that many teachers do perceive males and females differently as learners of mathematics and do hold different expectations for female and male learners of mathematics. These perceptions and expectations, in turn, do influence teacher treatment of females and males as learners of math. They expect boys to be better problem solvers, to persist in their mathematical activities longer, and to be more interested in math. Female students are less likely to be referred for mathematics assistance than are male students (Gregory, 1977). Underachieving female students are less likely to be behavior problems than are underachieving males and, as a result, less visible to their teachers.

To more clearly recognize teacher behaviors that contribute to sexism in mathematics education, consider the following scenarios. (Most scenarios are from E. Fen-

nema, A. Becker, P. Wolleat, and J. Pedro in *Multiplying Options and Subtracting Bias*, an intervention program designed to eliminate sexism in mathematics education, 1979, and developed under a grant from the Women's Educational Equity Act Program. Office of Education, 400 Maryland Avenue, S.W., Room 2136, Washington, DC 20202.)

Scenario I

(John and Sue, seated side by side in a mathematics class, are working on a mathematics problem.)

John: Sue, have you got this problem?
Sue: If you find the square root of *A*, you'll get the answer.
Teacher: Has anyone figured out how to get the answer?

(John's and Sue's hands both go up.)

Teacher: John, how did you get it?
John: If you find the square root of *A*, you'll get the answer.
Teacher: That's right! Did everyone see how John got the answer?

Many women report that others receive credit for their good ideas, and this scenario demonstrates a teacher rewarding the wrong student. Although it would have been difficult for the teacher to notice this student-to-student interaction, shouldn't a teacher be alert so that praise for good work goes to the correct recipient? Another point can be raised from this scenario.

Some women feel it is somehow unfeminine to appear to be too smart in mathematics, so they are reluctant to volunteer. Teachers can help young females to realize the importance of class participation.

Scenario II

(Mathematics class with the teacher moving around providing individual help)

Teacher: Have you figured out the answer, Marcia?
Marcia: Uh, no. Not yet.
Teacher: Eric, how about you?
Eric: I can't get it!
Teacher: Come on, Eric. You can do it. What's the exponent?
Eric: Oh yeah, x to the fifth. I get it now.

This is an example of both lowered expectations for females as well as the fact that problem solving is perceived as more important for males. By sticking with the male, the teacher helped him to have a successful experience. Her behavior also communicated to both students that mathematics was more important for males than for females.

Scenario III

Teacher: If the Rams have 3 touchdowns and the Packers have 2 touchdowns and a safety, how many more points will the Packers need to win the game?
Betty: Mr. Brown, how many points in a safety?
Teacher: (Ignoring Betty's question) Carl?

How can a female (or anyone) participate in problem solving if they don't know anything about the components of the problem? It is only good teaching to use examples understood by all students.

Scenario IV

Teacher: Today, we are going to have several men tell us how they use math in their careers.

Women use (or should be able to use) mathematics in their careers also. Both girls and boys should see examples of both women and men using mathematics. Role models are important!

Scenario V

Janet is taking too long to solve a mathematics problem. She finally exhibits the frustration she is experiencing by getting teary-eyed.

Teacher: That's OK, dear. Don't worry about it if it doesn't come out right.

Casserly (1975) refers to the phenomenon exhibited here as the "tear trap." Feelings of frustration cannot be alleviated by permitting a teary-eyed girl to fail in prob-

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Ed.'s note: Multiplying Options and Subtracting Bias, cited above, is available from the Council of Teachers of Mathematics, 1906 Association Drive, Reston, VA 22091

lem solving. Ways must be sought to keep the girl on task so she can feel success and increased confidence in mathematics.

Scenario VI

John is a gifted student who is excelling in mathematics. His teacher has encouraged him to join the mathematics club and arranged for him to take an advanced mathematics class at the local college. Mary, also a gifted student, finds mathematics very easy and she likes it. Her teacher feels she should try to become more outgoing and involved with other girls and social events at the school. The teacher urges Mary to join the debate team and a women's social club.

Teacher beliefs about sex-appropriate behavior result in different treatment of boys and girls. Not all females should have to succeed in social activities when some are much more suited for other types of roles.

Unfortunately, these scenarios are not fiction. They have been derived from reports by many females reflecting on their learning of mathematics. Teachers *do* treat male and female learners differently, and this differential treatment reinforces in females, as well as in males, the belief that mathematics is a male domain.

Sex is not an individual difference that should be considered.

The identification of teacher behaviors that differentially influence males and females should be viewed positively. Once such influential behaviors are identified, change can take place. Teachers can consciously observe their own behaviors and change those that contribute to females' feelings that mathematics is unimportant for them. Most important, teachers can develop sex blindness in their mathematics classes. There are many important individual differences that teachers should take into consideration when teaching: rate of learning, background experiences, and overall ability. However, sex is not an individual difference that should be considered. There is no individual difference important to the learning of mathematics that all females exhibit and all males do not, or vice versa. Each person in class should be treated as an individual whose needs and abilities must be considered. Boys as a group should not be treated differently than girls as a group, any more than all brown-eyed people should be treated as a group having specific learning needs. Expectations of females should be as high as expectations of males. Work demanded and received from females should be the same high quality that is demanded and received from males. Evidence clearly indicates that when females, especially high-achieving females, are expected to learn mathematics, they not only learn, but their achievement increases. In successful, bright girls' own words, "they were never treated like a girl," (Casserly, 1975).

Not only must teachers become sex blind in the treatment of their students, they must overtly help their students, especially their male students, overcome the sex typing of mathematics. High school males overtly stereotype mathematics as a male domain (Fennema and Sherman, 1978). It is placing a heavy burden on young girls to ask them to disregard what male peers believe is appropriate behavior. As long as males continue to stereotype mathematics as a male domain, it will be difficult to encourage very many females to study it.

There are also some specific things that teachers can do to reduce sexism in mathematics education. All conversations and remarks should be monitored so any negative or belittling references about women as learners or doers of mathematics are eliminated. Feelings about mathematics should be discussed with students. Since more females than males do report they are anxious about mathematics, providing help for mathematics anxiety will tend to benefit females. (This is not in conflict with the idea of sex blindness. Although more females

than males may be anxious, not all females are anxious, nor are all males confident. Anxious males deserve help as well as do anxious females. The anxiety is what is important, not the sex of the anxious person.) Although feelings about math anxiety should be appreciated, standards should not be lowered in the hopes that this will lower anxiety. Such lowering of standards merely suggests or reinforces a belief that one is not capable of learning mathematics. Students should acknowledge and take responsibility for their own learning. Persons who feel that their success is due to an internal, stable factor are much more apt to continue working in the area. Females, as well as the males, should participate in high level cognitive activities.

All students should be informed about the usefulness of mathematics. The fact that many career options are closed to those without knowledge of mathematics should be emphasized. Schools should not be making mathematicians of everyone (even if they could). However, preparation in studying mathematics beyond the minimal requirements keeps many options open, and schools should ensure that all students, females as well as males, have as many options as possible.

Teachers are important! Teachers can influence females and they should! As Grace Burton (1979) so aptly said, it is "the gentle persuasion of secondary school teachers of mathematics" that will enforce a change in the mathematics education of women.

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SEX ROLES IN MATHEMATICS: A STUDY OF THE STATUS OF SEX STEREOTYPES IN ELEMENTARY MATHEMATICS TEXTS

Henry S. Kepner, Jr. and Lilane R. Koehn

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Examples like the following were identified in the early 1970s by parent groups, educators, administrators, and legislators as representative of elementary mathematics materials that present a stereotyped view of women:

> Ruth is baking cookies. The recipe calls for 3/4 cup of sugar. If she wants to double the recipe, how much sugar should she use?
>
> Miss Jones types 30 letters today. If she types 12 by lunchtime, how many must she type after she returns?

Based on this awareness, arguments for the elimination of sexism in educational materials have been clearly stated in numerous journals, policy statements, and legislative acts (Brody 1973, Texas Education Agency 1974, California State Department of Education 1974). The key concern is that texts may provide norms for how boys and girls, and men and women should behave. Research data indicate sex stereotyping is one of the most important factors in the governance of behavioral development, motivation, and self-concept (Brody). Recent reports from the National Assessment of Educational Progress (NAEP) show that in most other learning areas tested "females tended to do better than males. However, the results for science and consumer mathematics shows females at a definite disadvantage. These data seem to reinforce the old stereotypes about female inability to cope with 'technical' or 'logical' subjects" (NAEP 1975 [a], p. 35).

Extensive sex stereotyping has been well documented in earlier textbooks (Mlinar 1973, Rogers 1975). But has sexism been eliminated from the more recently published elementary mathematics series (1971 through 1975)? To answer this question the authors examined texts from eight major publishers, chosen on the basis of recent publication dates and wide use of the series in schools. The first-, fourth-, and seventh-grade texts were examined in each

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series to determine whether sex stereotyping had persisted in activities and occupations portrayed in illustrations and in written problems. This sampling of grade levels was selected to identify differences that might appear as the format changed from pictorial mathematics to symbolic mathematics.

EVALUATION OF THE TEXTS

"All those attitudes and actions which demean or stereotype individuals or groups because of their sex" is a common definition of sexism (Sexism in Textbooks Committee 1974, p. 1). The authors used this definition and the California State Department of Education guidelines to develop an evaluation form for use with each text. (See figure 1.)

The authors found that an efficient way to evaluate a text was to page through the book twice--one time recording data on illustrations (all pictures, charts, and graphs), and another time recording data on problems (written exercises and examples).

For the first category (equal representation), recording the number of males and females shown in the illustrations or mentioned in the problems was sufficient. For categories 2 and 3 (occupations and activities), lists of occupations and activities involving males and those involving females were constructed for each text. The name of each mathematician identified was listed in category 4. Identification of attempts to use sexually neutral language (such as salesperson, fire fighter, or chairperson) or of blatantly

Figure 1

Evaluation Form for Sexism in Mathematics Texts

	Illustrations		Problems	
	Male	Female	Male	Female
1. Equal representation (record frequency of males and females)				
2. Occupations engaged in (list each occupation engaged in by a male or female)				
3. Activities participated in (list each activity participated in by a male or female)				
4. Mathematicians represented (name the mathematician identified)				
5. Sexually neutral language (note attempts to use sexually neutral language, and note blatant sexist language)				

sexist language (such as the weaker sex, authoress, or mankind) was planned in category 5.

RESULTS AND OBSERVATIONS

In examining the illustrations in the twenty-four books chosen, the authors found only one book that equally represented the sexes and two books that showed more females (51%) than males. In twelve, or one-half of the books, 60 percent or more of the people shown in illustrations were males. In two of the books, over 90 percent were males. The percentage of males and females shown in each of the eight series is listed by grade level in table 1.

Equal representation in problems occurred in only one textbook. Two of the textbooks included more females (52% and 51%) than males in the problems. The percentages of males and females in the problems for the twenty-four textbooks studied are contained in table 2.

Equal representation of the sexes in problems or illustrations in a book at a particular grade level did not indicate equal representation at all grade levels. For example, in Series H an equal representation of the sexes in illustrations occurred in the first-grade book. The percentage of males in the illustrations rose to 62.5 percent

Table 1
Percentages of males and females in illustrations

	Grade 1		Grade 4		Grade 7	
	M	F	M	F	M	F
Series A	59%	41%	67%	33%	66%	34%
Series B	53	47	63	37	64	36
Series C	63	37	52	48	53	47
Series D	49	51	57.5	42.5	58	42
Series E	100	0*	68	32	66	34
Series F	52	48	66	34	56	44
Series G	49	51	59	41	63	37
Series H	50	50	62.5	37.5**	92	8

*17 illustrations
**8 illustrations

Table 2
Percentages of males and females in problems

	Grade 1		Grade 4		Grade 7	
	M	F	M	F	M	F
Series A	0%	0%	62%	38%	66%	34%
Series B	48	52*	54	46	57	43
Series C	0	0	49	51	56	44
Series D	0	0	57	43	63	37
Series E	56	44**	50	50	57	43
Series F	58	42	65	35	56	44
Series G	0	0	57	43	56	44
Series H	67	33***	70	30	82	18

*23 problems
**18 problems
***9 problems

Table 3
Occupations given to males and to females in the grade 4 book of Series F

	Male	Female
Illustrations	farmer shoemaker	nurse
Problems	doctor farmer owner of a shop	clerk homemaker princess

in the fourth-grade book and to 92 percent in the seventh-grade book. (See table 1.)

Occupations given to males and females were listed for each of the texts studied. For example, table 3 is the list for Book 4 of Series F. In the illustrations, males were cited in two occupations; females in one. Each sex was identified in three occupations in written problems. In this book, males were given a total of four different occupations, as were females.

In elementary mathematics texts, males usually were shown in a greater diversity of occupations than females. This is shown in table 4, which gives the ratio of male occupations to female occupations for illustrations and written problems, as well as a ratio for both illustrations and problems combined.

When several occupations were cited for each sex, the types of occupations were not the same. (See table 3.) Teacher, clerk, homemaker, and nurse were the occupations most often given to females. Half of the seventh-grade books mentioned teacher as a female occupation; three mentioned clerk. In the twenty-four books studied, chemist and doctor were the only professional occupations, outside of nursing and teaching, given to females in the illustrations. There seemed to be no prevalent occupation for men. They were shown as bakers, lawyers, doctors, builders, farmers, football players, salesmen, astronauts, and so on.

In one text, males and females were given the same occupations. Book 1 of Series F identified both males and females as police officers, fire fighters, postal employees, musicians, and educators.

The number of activities participated in by males and females was approximately the same at each grade level, although males typically participated in more. This is shown in the ratios given in table 5. The types of activities, however, were vastly different. The activities females engaged in were predominantly passive, particularly in the illustrations. Their most strenuous activity was running a race, skipping rope, or riding a bicycle. Boys, on the other hand, spent most of their time engaged in strenuous physical activity. This included playing football, basketball, baseball, soccer, tennis, golf, lifting weights, running hurdles, doing gymnastics, or climbing mountains.

Female activity increased in the textbook problems. Besides doing their household duties, they played Ping-Pong, golf, and basketball; and went diving, hiking, bowling, and running. Males were still involved in a multitude of sports, but they also did work around the house--tiling a

Table 4
Ratios of occupations given to males to occupations given to females
(Combined illustrations and problems, illustrations, and problems)

	Grade 1			Grade 4			Grade 7		
	Comb.	Illus.	Prob.	Comb.	Illus.	Prob.	Comb.	Illus.	Prob.
Series A	*	*	*	5:1	1:0	4:1	6:2	4:0	2:2
Series B	*	*	*	4:3	2:2	3:2	6:4	[illegible]	3:1
Series C	*	*	*	2:5	1:2	2:5	7:3	0:1	[illegible]:2
Series D	1:1	1:1	*	2:1	0:1	2:1	2:0	1:0	1:0
Series E	1:0	1:0	*	2:2	*	2:2	7:1	3:1	4:0
Series F	8:6	8:6	*	4:4	2:1	3:3	10:9	9:6	3:3
Series G	0:1	0:1	*	5:0	4:0	3:0	4:1	1:1	3:0
Series H	*	*	*	3:1	*	3:1	9:0	4:0	5:0

*No male or female occupations were cited in the text.

Table 5
Ratios of male to female activities
(Combined illustrations and problems, illustrations, and problems)

	Grade 1			Grade 4			Grade 7		
	Comb.	Illus.	Prob.	Comb.	Illus.	Prob.	Comb.	Illus.	Prob.
Series A	3:1	3:1	*	8:9	6:3	5:7	6:6	4:3	4:3
Series B	*	*	*	7:6	3:0	4:6	17:14	5:3	15:11
Series C	5:4	5:4	*	9:11	7:9	2:2	11:7	6:0	7:7
Series D	6:5	6:5	*	10:12	2:0	8:12	5:3	*	5:3
Series E	*	*	*	7:5	4:1	3:4	4:3	2:1	3:2
Series F	2:3	2:3	*	24:15	14:7	11:10	11:11	9:6	3:6
Series G	5:2	5:2	*	5:6	4:3	2:4	6:2	2:0	4:2
Series H	3:3	3:3	*	2:2	*	2:2	7:5	2:0	5:5

*No activities were cited that involved males or females.

floor, building a fence, shoveling snow, raking leaves, mowing a lawn, and cooking.

There were few activities in any of the twenty-four books that males and females participated in together.

Names of mathematicians did not appear until in the seventh-grade books. Of the seven series in which they did appear, the number mentioned ranged from one (Series B and D) to fourteen (Series G). The mathematicians were all males.

The authors found neither blatantly sexist language nor overt efforts to use nonsexist language. This could have been due, in part, to the format of elementary mathematics textbooks. Prose is used only in brief explanations or problem sets.

SUMMARY

An operational definition of sexism in textbooks was given by the Sexism in Textbooks Committee of Scott, Foresman and Company (1974, p. 1):

> Textbooks are sexist, if they omit the actions and achievements of women, if they demean women by using patronizing language, or if they show women or men only in stereotyped roles with less than the full range of human interests, traits, and capabilities.

Research has revealed sexism in earlier mathematics texts. Is there sexism in the more recently available mathematics series? This review of the first-, fourth-, and seventh-grade texts from eight popular series published in the years 1971 through 1975 indicates that sexism is still very much in evidence.

Males and females were seldom treated equally in the illustrations and problems in these texts. The number of males identified was greater than the number of females identified in twenty of the twenty-four texts examined. Males participated in a greater variety of activities and occupations than females. Typically, female roles were passive rather than physically active, except when they participated in household activities. Females were not portrayed as having a full range of interests, traits, or capabilities.

Few situations existed where males and females participated together in an activity, except in family settings. This is a subtle form of sexism transmitted by textbooks.

There was little evidence of sexist language in the materials surveyed. In large part, this was a result of the standard mathematics text format of examples and computational exercises.

While specific mathematicians were identified only in the seventh-grade texts, these individuals were exclusively male. This is one more way in which mathematics texts presented mathematics as a male activity. Psychologist Jerome Kagan has found that children display inhibitions about learning subjects they feel are inappropriate for their sex. Recent National Assessment results showed the effects of sexism on "more difficult exercises and word problems." Adult and 17-year-old males outperformed females on these exercises (NAEP 1975 [b], p. 21).

With sexism prevalent in textbooks published as recently as 1975, it will be several years before nonsexist mathematics texts appear in most elementary classrooms. Multi-year adoptions and revised editions, with only minor changes, will prevent sudden changes in the commercial materials available to students. Teachers must be involved in seeing that future adoptions present an equal view of males and females in mathematics materials. In the interim, classroom teachers must consciously seek to present women in a wider variety of activities and occupations involving mathematics. This can be done through supplementary exercises and problem settings constructed by the teacher or a school-wide group.

UPDATE

Since the original data were collected, new texts have appeared. The authors carried out an analysis of three widely advertised new series. Two are revisions of texts used in the original study: Series E' (1975-76) and Series G' (1976). Series G' has no seventh-grade revision. One new series was added to the study, Series I (1976-77).

An examination of the illustrations in these texts indicated only minor changes in the percentage of males and females shown. One exception was the revised Book 1 in Series E'. The 1972 text had males in 100 percent of the seventeen recorded illustrations. In the 1975 revision,

Table 6
Percentages of males and females in illustrations

	Grade 1		Grade 4		Grade 7	
	M	F	M	F	M	F
Series E'	68%	32%	61%	39%	61%	39%
Series G'	51	49	54	46	*	
Series I	55	45	58	42	53	47

*No revised seventh-grade text.

Table 7
Percentages of males and females in problems

	Grade 1		Grade 4		Grade 7	
	M	F	M	F	M	F
Series E'	0%	0%	45%	55%	43%	57%
Series G'	0	0	47	53	*	
Series I	0	0	52	48	48	52

*No revised seventh-grade text.

males were identified 68 percent of the time in almost seventy recordings (table 6).

A study of sex roles in the problems indicated a noticeable shift. Although problems were not human-oriented in the new first-grade texts, the problems in the fourth- and seventh-grade texts showed a larger percentage of females than males, with only one book having males identified more often (table 7).

In the more recent texts, females were cited in an expanded range of occupations. This was most notable in the seventh-grade texts. In Book 7 of Series E', females were identified in the following occupations: welder, draftswoman, zoo keeper, film reviewer, political candidate, disc jockey, luggage carrier, veterinarian, and truck driver. An overview of all texts suggested a stereotyping of women in the roles of doctor and construction worker.

Although females were cited in many more occupations than in the past (table 8), males were not pictured in traditionally female occupations. A rare exception was a male hairdresser in Book 7 of Series E'.

The number of activities participated in by males and females remained approximately equal in the new texts. The advantage, now, is to the females (table 9).

In activity settings, females typically remained in passive roles. However, there were examples of females engaged in more physical activities such as pounding nails, racing a boat, tiling a floor, delivering newspapers, building a cage, playing baseball, and plowing a field. There were also isolated examples of males cooking, planting flowers, sewing on a button, and cheerleading.

With respect to the identification of mathematicians, Series E' mentioned three, all males, in the fourth-grade text. In the seventh-grade text, 9 male and 4 female mathematicians were identified.

Table 8
Ratios of occupations given to males to occupations given to females
(Combined illustrations and problems)

	Grade 1	Grade 4	Grade 7
Series E'	0:2	11:7	19:19
Series G'	0:1	2:0	*
Series I	4:1	16:6	10:16

*No revised seventh-grade text.

Table 9
Ratios of male to female activities
(Combined illustrations and problems)

	Grade 1	Grade 4	Grade 7
Series E'	1:1	9:11	6:3
Series G'	2:1	7:10	*
Series I	6:6	12:18	6:9

*No revised seventh-grade text.

There was an increased use of sexually neutral language in the new texts reviewed. This was primarily accomplished through the avoidance of singular pronouns. The use of Ms. was much more common in these texts.

In comparison to the data collected on texts published in the 1971-75 period, a review of texts in the 1975-77 period shows some changes in sex roles. The most noticeable change is the greater variety of occupations given to females in illustrations and problems. Although less complete, there is an involvement of females in physically strenuous activities.

The detailed tallying of occurrences shows that the appearance of males and females in illustrations and problems is more balanced. Although not equal in number, the percentage differences are less than in earlier texts.

CONCLUSION

After thorough examination of the texts, the authors are concerned about the possibility of stereotyped sex-role changes in the series. Females have been stereotyped into roles as doctors and construction workers. They were typically playing baseball or basketball. Although these roles are being assigned to females, there is little indication that male roles are changing. Neither was there an increase in joint male-female activities. Teacher awareness and involvement are still needed to present a balanced view of males and females in mathematics.

Authors' Note. The names of the textbook series, referred to as Series A-H, E', G', and I in this article, can be obtained by writing to the authors.

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UPDATE ON SEX-ROLE STEREOTYPING IN ELEMENTARY MATHEMATICS TEXTBOOKS

Helen Fuesy Kuhnke

An assistant professor of mathematics education at the State University of New York-College at New Paltz, Helen Kuhnke teaches preservice and in-service elementary teachers. She also works on curriculum development and does in-service workshops for surrounding school systems.

The awareness of sexism in the curriculum (Frazier 1973) and the numerous articles on sex-role stereotyping in elementary textbooks prompted me to take a close look at some elementary mathematics series myself. Since I had immediate access to them, I examined two sets of elementary mathematics texts, kindergarten through grade six, both with 1974 copyrights. I am pleased to report that my examination of these books indicates that apparently an all-out effort has been made to eliminate the sexist bias and offensive sex-role stereotyping.

BACKGROUND

The critics of elementary textbooks had made a valid case. Sex-role stereotyping was found in spelling, science, mathematics, reading, and social studies books. Weitzman and Rizzo (1975), in one of the most comprehensive studies done on the subject, found ample evidence of sex-role stereotyping:

Most pictures show girls passive and boys active--girls indoors; boys outdoors, being skillful and adventuresome.

Throughout the texts, girls are shown sewing, baking, mopping, making beds, dusting, and washing dishes.

Girls are affectionate, frighten easily, and cry.

Boys are strong and silent, almost never cry.

Pictures showing boys and girls together frequently have the boy doing something clever, and the girl thrilled to watch.

The housewife in the textbooks is hard to believe. Everything goes smoothly and she is always happy and calm. She also has little to do and often is shown sitting.

Motherhood is shown as the only option for girls.

Weitzman's report, however, made the point that the average woman

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in the United States spends only one-third of her adult years raising children. Most women will want to work, or will be forced to work, during the other two-thirds of their lives.

The criticism of children's readers has had much general publicity and was further documented in a booklet, Dick and Jane as Victims: Sex Stereotyping for Children's Readers. Here, too, authors cautioned that children are assimilating the content and values of their books as they learn to read, without giving it any conscious thought. They admonished that "school readers must assume their responsibility in directing the subliminal learning process towards more psychologically constructive ends" (Women, p. 32).

The most surprising accusation, however, has been sex-role stereotyping in mathematics books. In a consciousness-raising paperback, And Jill Came Tumbling After: Sexism in American Education, Federbush categorized the stereotyping in three phases:

> 1. the standard textbook variety, where pictures of girls showed them doing girl jobs like sewing, cooking, and other female chores, while pictures of boys showed them doing boy jobs like sailing, mountain climbing, woodworking, or going to the moon. The standard texts even verbalized, "Susan couldn't do the problem . . . Jim showed her how," or "I guess girls are just no good in math," said Joe;
>
> 2. the historical omission variety--not one female mathematician was ever mentioned;
>
> 3. the new mathematics variety, where the use of sets gets into stereotyping when it separates people. Sets of boys are usually doing things while sets of girls are sorting such things as hair color/eye color. Again, sets of men are doctors, lawyers, pilots, astronauts, mailmen--you name it. Women may be waitresses, nurses, stewardesses, and funny hat wearers, but not much more (Stacey et al. 1974).

Federbush did mention that sex bias in books is almost certainly committed unintentionally, and without malice--at least without conscious malice. But because it is frequently so subtle or so ordinary looking, we must continue to make sure that it is exposed and corrected. She suggested that a set of guidelines be drawn up and presented to companies to use as directives to authors and artists preparing new books. The main categories would deal with--

- adult stereotyping, in occupational and family life;
- boy-girl activities, values and groupings;
- problems involving male/female competency in mathematics; and
- inclusion of female mathematicians.

Federbush also suggested that a good safe rule of thumb would be to divide all roles and activities evenly wherever possible. It would certainly be more reasonable than the current textbook pictures and descriptions. "What is desirable is realism (female taxi drivers) plus a little exaggeration (female astronauts)--and the way life is moving in America, what is extraordinary today may be commonplace tomorrow" (Stacey et al. 1974, p. 182). Federbush felt that carrying out

the program of action that she suggested "would be one more step toward helping our young and our very young women feel like unapologetically capable and aspiring human beings."

WHAT I FOUND

Obviously, my consciousness of sex stereotyping in mathematics texts was aroused. Reading the copy and viewing the pictures in the mathematics textbooks that I had access to revealed that (a) there definitely was a concern for adult stereotyping, (b) boys and girls were frequently involved in tasks jointly, and (c) problems involving male/female competency in mathematics let the girls be smarter sometimes. Nothing was done about the inclusion of female mathematicians, but there were no comments about men of mathematics either.

Men and women, boys and girls, were featured in unusual stereotyped roles. In instances where names were used or sexes were designated, new roles emerged for both sexes. In their new roles females had different jobs, took the initiative, were active, displayed responsibility, and made decisions. Males were also shown in nonstandard situations--they were not always the he-man roles. There were pictures that showed that men could do some domestic chores without losing face--to be sure, these tasks were more likely chosen than done out of necessity.

In the following examples the first lines of the problem often made the point. Sometimes the picture carried the message even if the page was all practice exercises:

New female roles

"Miss Cabot runs a paint store."

"Brenda is a potter. . . ."

"Allison has a sandal shop. . . ."

"Meg wanted to change her bedroom furniture around." (She measured her things and made a scale drawing. In the past boys usually were the measurers.)

"Bertha could walk .7 kilometers."

A girl is pictured jumping over a fire hydrant. This clearly shows new action and freedom from Mary Janes and pretty dresses.

"Mrs. Brown hired Mr. Washington to lay tile in her kitchen."

"Madeline was driving one car, while her husband followed in the other."

". . . . Miss McConnell will leave the United States for a business conference in Oslo, Norway." Her travel agent prepares a chart, route, and expenses.

In a picture of a school medical center, the doctor is definitely female.

On a problem-solving page, both sexes were involved, but the picture shows a girl as a scientist and the copy reads, "Flora uses mice to test different diets."

"Miss Anton is going to paint 24 new houses." In another problem Miss Anton also hangs wallpaper.

A girl is pictured on parallel bars as a gymnast simply to demonstrate parallel lines on a geometry page.

Another garage scene shows men and boys working, but Mrs. Washington buys gas. (Women are out of the kitchen.)

New male roles

"George is using his science textbook and measuring foods for grams of protein."

"Jack had trouble making a box. He asks his father. . . ."

"Jack used 2/3 cup of milk for a batch of pancakes."

"Gary is making milkshakes for some of his friends." He uses a recipe.

"Alan is making cookies. His recipe calls for. . . ."

"Matt is having trouble choosing one of these buckles." He decides to put them in a box and then reach into the box without looking to pick one. The problems relate to probability.

"Tom bought 4 1/2 yds. of material. . . ."

"Mr. Allen made 36 loaves of bread."

A man is pictured as a gardener.

To be sure, all the roles were not turned around. Boys still had some special tasks such as paper routes, playing ice hockey, garage helpers, and Boy Scouts. Girls were still playing jacks, raising flowers, and going shopping for mother.

Boys and girls together

The greatest number of pages showed boy-girl activities with similar values and groupings. Boys were not the active members with girls watching the events from the sidelines. Together they were fishing; sailing boats; ice skating; preparing for hikes; going to museums; helping in the library; going to the airport; participating in potato sack races, swimming meets, and softball games. Sometimes the girls even won or came out ahead. When two boys and a girl were doing examples on the blackboard, one boy and the girl had the correct answers.

There were a few ambiguous situations. The artwork would show a drugstore scene and both a male and female were in uniform. There was no way of telling which was the clerk and which was the pharmacist. In a large bakery both sexes were in uniform working side by side. If Jay and Schminke (1975) put the heavy responsibility on the classroom teacher to counteract the impact of sex stereotyping in textbooks, then the publishers of these textbooks have made it easier for the teacher who chooses to set the tone for career expectations.

Nonsexual terminology also avoided stereotyping. "Central City has 1600 transportation workers. Twenty percent drive buses. How many workers drive buses?" On one page the artwork evaded making the differentiation and one could only infer that it was a picture of a police officer.

CONCLUSION

The review of these two mathematics textbooks series shows a positive response from the publishers to the critics of sex role stereotyping, which indicates that the biases in textbooks can be eliminated when a concerted effort is made. The conscientious work of many people in citing the sex role stereotyping has had far-reaching effects in many areas. Even if the change in the curriculum and in society is not immediate, consciousness raising must be considered an important accomplishment.

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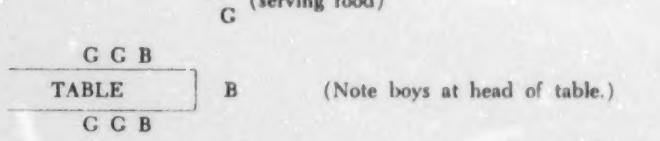
SEX STEREOTYPES IN MATHEMATICS AND SCIENCE TEXTBOOKS FOR ELEMENTARY AND JUNIOR HIGH SCHOOLS

I. The Sex Component of Set Theory

Is the following an innocent exercise in permutations and combinations?

> There were 4 boys and 5 girls at a party. In how many different ways can one girl be matched with one boy for a game?
>
> (Deans et al., *Developing Mathematics*, Book 3 [Gr. 3])

Problem: To diagram the proper relationship between boys and girls. Answer:



(Abstraction of picture found in Keedy et al., *Exploring Modern Mathematics*, Book 1 [Gr. 7])

Are the following sets joint or disjoint?

> The set of all boys who play football and the set of all boys who play baseball.

Note: By Josephine Mlinar. Reprinted with permission from *Report on Sex Bias in the Public Schools*. Copyright © 1973 by the Education Committee, National Organization for Women, New York City Chapter (28 East 56th Street, New York, New York 10022).

> The set of all girls who have short hair and the set of all girls who have blue eyes.
>
> (Gundlach et al., *Mathematics 5* [Gr. 5])

Clearly, it is implied that the set of children (boys) who are characterized by their physical activity and the set of children (girls) who are characterized by their physical appearance are disjoint.

Consider the following family activities in a camping scene from a second-grade text (Duncan, *Modern School Mathematics, 2* [Gr. 2]):

Female: Mother cooks on outdoor grill; girl watches baby.

Male: Father sets up tent; boy helps father; boy sails boat; boy romps with dogs.

The female members of the family are occupied with "homemaking" activities. The male members, by contrast, are involved in physically vigorous, "building" or "play" activities. The two boys at play are obviously engaged in *optional* activities, which permit them to develop independence and to increase their range of experience. No such choice is apparent in the female activities.

Let's examine the first-grader's view of male and female roles. Consider the pictures found in the first 100 pages of a first-grade text (Duncan, *Modern School Mathematics 1* [Gr. 1]):

Female:	*Activity shown or implied:*	*Male:*	*Activity shown or implied:*
Indian girls	none	sailors	sailing
queen	ruling (with king)	band members	marching, playing music
dolls	none		
witches	casting spells	king	ruling (with queen)
Eskimo girls	none	bakers	baking
girls	buying balloons	pirates	plundering ships
girls	skipping rope	circus performers	performing
		knights	jousting
		man	observing stars
		clowns	clowning
		man	selling balloons
		boy	raising pumpkin
		boys	swimming
Indeterminate:		Indian chiefs	ruling Indians
skiers		Indian men	war dancing
		variously dressed men	none

There are curious differences between the male and female images. In the first place, there are many more male images (15 to 7). In the

second place, only one male picture is totally passive (no action shown or implied), whereas nearly half of the female pictures (three) are passive. The varied male adult roles are generally realistic (sailor, band member, baker, circus performer, astronomer, clown, balloon salesman) and include several ways of earning a living. The female adult roles are not realistic (queen, witch) and no reasonable way of earning a living is shown. The girls, however, may *spend* money (buying balloons).

The seventh grade sees the pattern repeated in problems (Keedy et al., *Exploring Modern Mathematics*, Book 1 [Gr. 7]):

Female activities: Buying chocolate creams; using flour; buying gingham; baby-sitting to earn *extra* money; walking to school; being 4 feet tall; finding mixed numerals in an easier way (than boys); writing a fractional numeral; using a skirt pattern; serving candy; using lace on a blouse; ordering a floor tile; making towels; making dresser scarves.

Male activities: Gardening; building scenery; growing 2½ feet taller; planting grass; cutting a board; painting a room; hiking 50 miles; running 100-yard dash; being 5 feet tall; finding an average; copying a house plan; having a 7 foot board; finding mixed numerals; showing a shorter way (than a girl's) to write a fractional numeral; painting a living room; driving; trying to correct a fractional numeral; filling boxes with candy; making baskets (basketball); delivering groceries by bicycle; cutting bookshelves; cutting a board; dividing fractions; carrying the ball in a football game; selling pine trees.

Girls and women spend a great deal of time sewing and cooking. Walking to school is their most strenuous activity. Girls baby-sit to earn "extra" money. Their accomplishments are the private production of clothing and food, which wear out and are eaten respectively. Girls, unlike boys, don't spend leisure time playing or relaxing.

Boys and men spend considerable time in carpentry, painting, and gardening, which result in relatively permanent accomplishments. They engage in strenuous sports in which they achieve public recognition. They earn money (delivering groceries, selling pine trees) or practice money-making activities (copying a house plan)—and nowhere is it suggested that this money is "extra." Male examples are used 26 times; female examples only 15 times. Only in school may boys and girls participate on an equal basis.

Finally, let us consider the field of mathematics itself. What role

models are presented? Surely there could be no problem here, since mathematics is intrinsically abstract and asexual.

Female mathematicians: None.

Male mathematicians: Eratosthenes; Goldbach; Euclid; John Napier; Fibonacci; Pascal.

The great algebraist Emmy Noether is not even mentioned. Even Stein's book which is very abstract, conforms to the practice of omitting female role models (Stein, *Fundamentals of Mathematics* [Gr. 8–10]). All the mathematicians above are cited with corresponding accomplishments. A girl could not help but conclude that there are no female mathematicians; and if there are, they have never done anything worthwhile.

Is there a ray of hope in the darkness? The Spitzer et al. series, *Elementary Mathematics*, appears at first to be totally unbiased as to sex. The reason for this is that nearly all of the examples of boys and girls in the text (on nearly every page) depict class participation. Thus, nearly all the examples are nonstereotyped. Nevertheless, nonclassroom activities are very much stereotyped:

Female activities: Papering cupboard shelves; using red ribbon; filling an aquarium; reading.

Male activities: Assembling a fishing rod; playing with planes; making a boardwalk across a puddle; buying paint (Spitzer et al. [Gr. 4]). Loading a truck with newspapers; loading a truck with melons; marking cans in a grocery; finding the height of a water tower; finding how far radar signals travel in 1 hour; racing a boat; practicing music; catching fish; helping in a local paper drive (Spitzer et al. [Gr. 6]).

Here we have all the usual stereotypes: female restriction to indoor, nonstrenuous, nonremunerative, and nonscientific activities which produce no permanent result. Boys may also engage in such activities, but generally their activities have some, if not all, of the opposite characteristics, and are much more varied.

The art of mathematics sex stereotyping is obviously far advanced and all-pervasive. Some recommendations to remove sex stereotyping are:

1. Inform publishers that henceforth texts will be screened for frequency and type of male and female role models and examples. Only nonstereotyped books will be acceptable.

2. All current texts should be screened similarly. Publishers should be notified of necessary corrections. Books should be dropped from the official textbook list if corrections are not made immediately.

II. Sex Education in the Science Lab

> A scientist is a human being like yourself. *He* has much the same sort of everyday problems you have. But *he* also attempts to solve problems about what is in the world around *him*. To do this, *he* is always looking for facts that will help answer *his* questions. (Emphasis added.) (Beauchamp et al., *Everyday Problems in Science* [Gr. 8–9])

Grade 1: Establishment of adult sex-role models

Aim: To establish clear differences between adult male and female sex roles. To prepare girls for later invisibility via paucity of pictures of adult women.

Means: Examples of children imitating adult sex roles and pictures illustrating appropriate sex-role differentiation.

Adult female pictures: Walking in the rain; shooing pigs into a sty; checking a thermometer and putting a coat on a boy; taking a coat from the closet; getting caught in an elephant's trunk.

Adult male pictures: Walking in the rain; holding balloons; setting out smudge pots in orange groves; holding a briefcase; walking against the wind; swimming around a capsized boat; extricating a truck from the mud; painting a gutter; introducing a circus act; clowning; selling balloons; spilling nails; riding a motorcycle, hosing down a sidewalk; putting cows in a barn.

Adult role model imitations

Boy raises chair above head, while girl holding chair waist-high looks on admiringly.

Father paints, boy piles fallen twigs in wagon, boy mows lawn, girl sweeps.

Man rides motorcycle, boy drives horsecart, boys climb tree, girl bounces on pogo stick.

Grade 2: Establishment of acceptable female sex roles outside the home

Aim: Establish appropriate female occupations. Contrast with male occupations which tend to exert control over the immediate environment. Emphasize female service to males. Accustom girls to invisibility via a lack of pictures of girls, combined with many pictures of boys encompassing a wide range of experiences.

Means: Pictures indicating acceptable behavior and subjects.

Adult female: Nurse describing a heart, showing pulse to boys, and giving them shots; packers in an assembly line packing corn.

Adult male: Driving a combine; herding cattle; spraying trees.

Girl: No activity.

Boy: Exploring woods; watching a butterfly; climbing a log; dismembering a flower; listening to a nurse describe a heart; observing a pulse as shown by nurse; eating a sandwich; holding a grapefruit; getting a shot from a nurse.

Grade 3: Establishment of feminine nurturance; establishment of male technological aptitude

Aim: To prepare girls for their future duties as homemakers via appropriate adult and child role models. To inculcate a sense of male technological monopoly in all areas except homemaking.

Means: Pictures illustrating homemaking and nurturant behavior in females. Careful exhibition of acceptable uses of technology by each sex.

Adult female: Sewing; ironing; baking.

Adult male: Reading the paper.

Girl: Feeding goldfish; placing a plant in the sun; looking at a plant; looking at teeth in a mirror; exploring woods; polishing a floor; watching TV.

Boy: Holding mirror for a girl; wearing an outgrown suit; feeding a puppy; exploring woods; demonstrating a magnetic field of electric current; watching TV; drawing with a soldering iron; experimenting with current.

Grade 4: Inculcation of male leadership role

Aim: To present leadership as an inherently male function. To drive home the connection between power and maleness. To further emphasize the invisibility of females outside the classroom. To present scientists as exclusively male.

Means: "Investigation pages" to encourage student experimentation, with males shown as leaders in experimental activities. Pictures and text which depict males almost exclusively. Description of the work of male scientists only.

A. Investigation Pages:

"Chemical and Physical Changes"

1. A male short-order cook frying pancakes.

2. Melting ice—A boy checks a thermometer and records temperature while a boy and a girl watch.
3. Physical state of butter—Two girls check a thermometer and record temperature.
4. Physical changes: a man saws wood, a boy breaks twig, a girl tears paper.
5. A boy in a baseball uniform eats lunch.

"Energy to Do Work"

Two girls make a pendulum, then—a boy measures the pendulum, swings pendulum, adds weight to pendulum, and shortens pendulum.

B. Pictures:

Adult female pictures: Removing cake from oven.

Adult male pictures: Putting anti-freeze in a car; extinguishing a candle with a jar; extinguishing a candle with a tweezer; adjusting chemical equipment; James Prescott Joule; packing boxes; driving a tractor; driving a locomotive; adjusting equipment in a plant.

C. Text:

Adult female: No activity.

Adult male: Joule's work; Einstein's work.

Girl: No activity.

Boy: Pushing a box; playing baseball.

D. Scientists Described:

James Joule, Percival Lowell, Clyde Tombaugh, other men indexed.

Grade 5: The male as paid worker

Aim: To firmly inculcate the image of the male as paid worker. To emphasize the concept of woman as child; to denigrate the value of her work. To further stress women's invisibility. To present male scientist role models.

Means: Pictures of males in various remunerative occupations. Text references to males in various activities, especially science. Omission of females in pictures. A "Scientists in Action" section acclaiming the accomplishments of male scientists.

A. Scientists in Action:

Luther Burbank (botanist)
Robert Hutchings Goddard (rocket developer)

John H. Glenn (rocket pilot)
Vilhelm Bjerknes (meteorologist)

B. Pictures

Adult female: Watching male TV image; singer ("girl").

Adult male: Using a solar cell; repairing a telephone line; shaving with an electric shaver; TV cameraman; male announcer; male TV image; satellite ground controller; disk jockey; doctor; TV engineer; driving a car; riding a rocket chair.

Girl: Talking on the telephone; schoolgirls "transmitting a picture."

Boy: Talking on the telephone; jumping off a wagon.

C. Text

1. "You have heard your *father* talk about the battery in *his* car. You know *he* cannot get the car started without it." (Emphasis added.)
2. Discussion of Isaac Newton and Newton's Laws of Motion.
3. Discussion of action and reaction when boy jumps out of wagon.
4. Action and reaction with reference to man riding a rocket chair.
5. Transportation necessary to visit one's grandmother in California.
6. "The girl here is singing into a microphone." (Picture of a mature woman)
7. Thomas Edison's inventions.
8. Policemen's use of radar.

Grade 7: The male scientist

Aim. Depiction of male participation in various scientific activities. Admission of Marie Curie to the male scientist elite.

Means: Pictures of male scientists at work. Text describing male scientific accomplishments. Multiple male scientist role models. Emphasis on male use of technology.

A. Pictures

Female: Madame Curie in lab; radioactive testing of piston wear.

Male: Pierre Curie in lab; researching of radioactive substances; radioactive testing of piston wear; inspecting an atomic reactor; assembling a satellite; Ernest O. Lawrence by his cyclotron; observing a fusion demonstration; adjusting a stellerator; Newton; Rumford; Joule; lighting a piece of wood in a solar furnace; with fuel cell; generating electricity with a teakettle; with sunlight collector; with cesium cell; with biochemical cell.

Indeterminate: Using Geiger counter.

B. Text

1. Scientists whose accomplishments are described

Female: Marie Curie.

Male: Antoine Henri Bequerel; Pierre Curie; Ernest Rutherford; Ernest O. Lawrence; Milton S. Livingston; Enrico Fermi; Otto Hahn; Glenn Seaborg; Edwin McMillan; Abelsun; Aristotle; Sir Isaac Newton; Benjamin Thomson Rumford; James Joule; Thomas Edison.

2. "Primitive *man* used only *his* muscles to produce energy, but *he* soon found out that *he* could not do very much work by *himself*. Animals were probably *man's* first outside source of energy, but they could not provide all the energy *man* wanted. *Man* then built machines to use the energy of wind and water and eventually began to use fuels such as wood, coal, and later oil to supply the energy needed to run *his* machines."

"*Man* needs a great deal of energy to operate the large machines that do *his* work. Before the invention of engines that burned fuel to release energy, the only available sources of energy, in addition to *man's* own muscles, were animals, water, and wind. Water wheels are one of the earliest known machines used by *man* to obtain energy from flowing water for *his* needs. . . . The wind has long been a source of energy used by *man*." (Emphasis added.) (Blanc et al., *Man, Matter, and Energy* [Gr. 7–9])

Grade 8: A career in science (women need not apply)

Aim: To establish masculinity of scientific careers and behavior.

Means: Coordination of generally nonsexist text with pictures portraying males in various scientific fields. Use of male scientist role models. Depiction of males as scientific thinkers.

A. Text: How Do Scientists Think and Work?

Female: None.

Male: Aristotle; Galileo; Louis Pasteur; Thomas Edison; Jan Lippershey; Zacharias Janssen; Anton von Leeuwenhoek.

B. Pictures

Female: Observing through microscope.

Male: Repairing a generator; observing electronic equipment; checking gauges; chemist testing material; physicist using equipment; geologist studying rock samples; geologist charting rock layers; biologist simulating Martian conditions; man ("you") solving problem

of extricating a model plane from a tree; using an electron microscope; using high-speed photographic equipment; using analytical balance; working in a lab.

Mathematics Textbooks

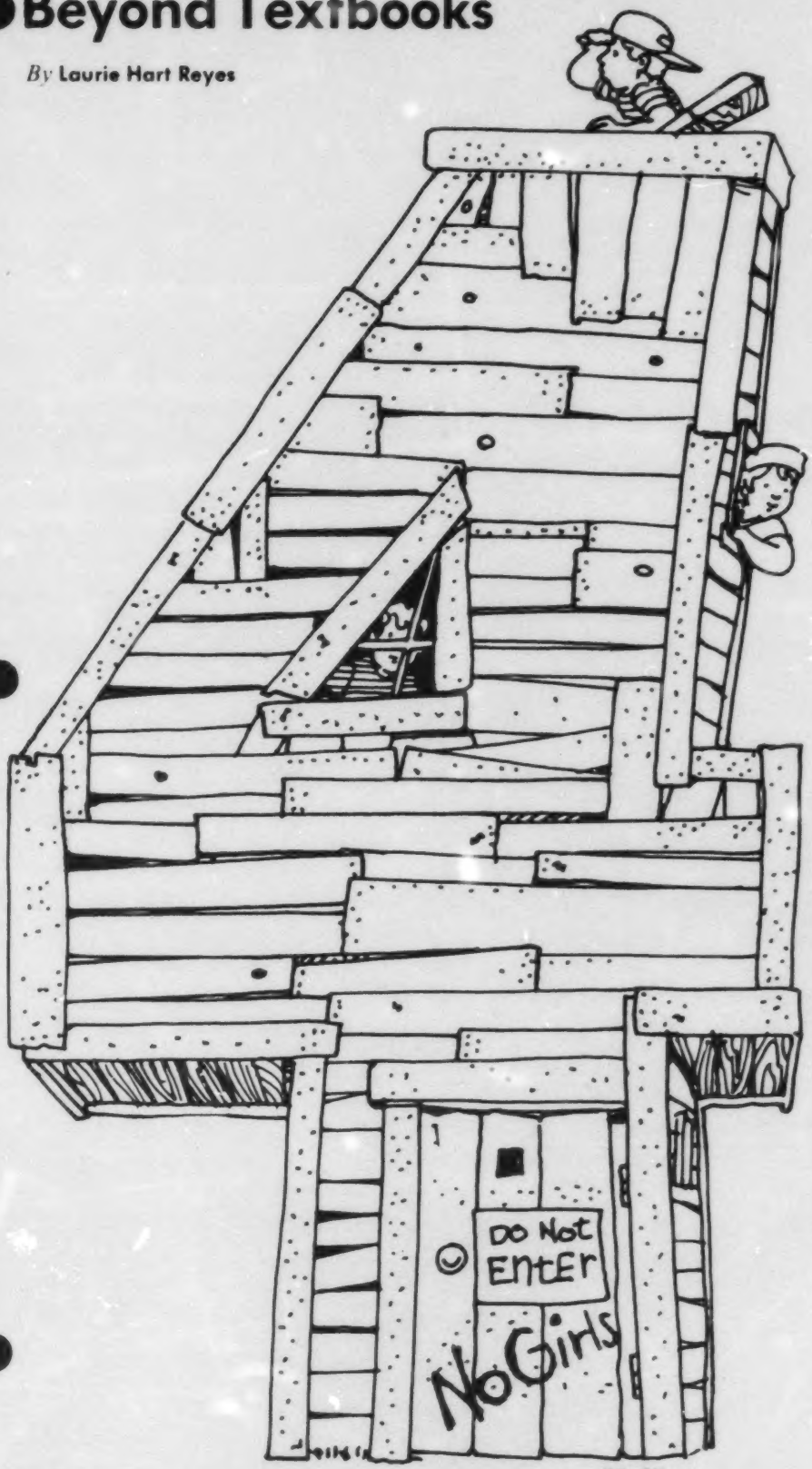
Grade	*Text*	*Section (pp.) Reviewed*
1	Duncan, *Modern School Mathematics 1*	1–100
2	Duncan, *Modern School Mathematics 2*	100–200
3	Deans et al., *Developing Mathematics*, Book 3	50–150
4	Spitzer et al., *Elementary Mathematics*, Book 4	1–25
5	Gundlach et al., *New Laidlaw Mathematics Program*, Mathematics 5	1–50
6	Spitzer et al., *Elementary Mathematics*, Book 6	25–50
7	Keedy et al., *Exploring Modern Mathematics*, Book 1	100–200 (pictures) 150–200 (problems)
8–10	Stein, *Fundamentals of Mathematics*, Second Course	1–100

Science Textbooks

1	Beauchamp et al., *Science is Fun*	Weather We Move Things
2	Mallinson et al., *Science 2*	Man among the Animals of the World
3	Beauchamp et al., *Science is Exploring*	How Do Living Things Get Food? Electric Current
4	Jacobson et al., *Probing into Science*	Materials of the Earth Energy to Do Work
5	Munch-Syrocki *Book V*	Energy and Matter Scientists in Action
7–9	Blanc et al., *Man, Matter, and Energy*	Matter and Energy Forms and Sources of Energy
8–9	Beauchamp et al., *Everyday Problems in Science*	How Do Scientists Think and Work (includes quote used to introduce science section)

Sexual Stereotyping in Mathematics: Beyond Textbooks

By **Laurie Hart Reyes**



The May 1977 issue of the *Arithmetic Teacher* included three articles that discussed some of the issues involved in the problem of sex-role stereotyping and mathematics learning. Fennema and Sherman reviewed and analyzed the sex-related differences in mathematics learning and studying that have been found in research. They hypothesized that many females elect not to take mathematics in high school and college because mathematics is perceived as a male area of study and therefore inappropriate for females. The other two articles—one by Kepner and Koehn, the other by Kuhnke—examined the extent of sex-role stereotyping in elementary mathematics textbooks. In the latter two articles there was a sense that (a) things are changing on their own so we have nothing more to do and (b) once sex-role stereotyping is removed from elementary mathematics texts we will have provided equity for females in the study of mathematics.

There is value in recognizing when mathematics texts stereotype girls and boys into inflexible roles. Certainly both girls and boys are capable of a tremendous variety of interests, feelings, and activities. The view that mathematics is for males and not for females may be seen in textbooks, but changing society's attitudes toward women and mathematics is a very complex task. There are many factors that influence girls in choosing whether or not to take more mathematics courses than those required for graduation. It is not clear what effect removing stereotyping from elementary mathematics texts would have on the decisions of girls concerning the study of mathematics. It does not seem likely that

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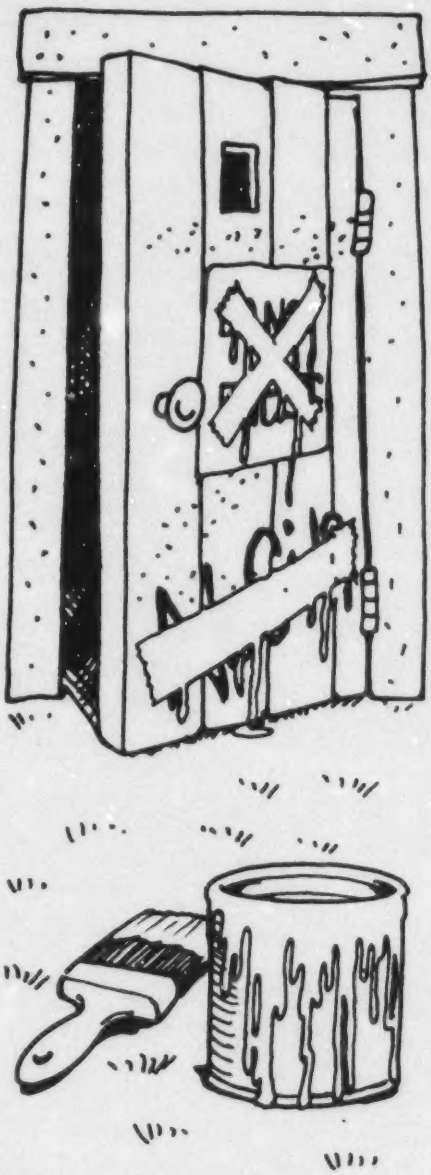
changes in textbooks will be a major key to a remedy. One danger in focusing attention on textbooks alone is that we might transfer our sense of responsibility to the publishing companies. This could lead to the feeling that once sexism has been removed from mathematics books our job is done.

Let us examine some of the other factors involved in the sexual stereotyping of mathematics. Parents, classmates, and teachers are important molders of attitudes in females (Sells 1973). In their AT article (p. 371), Fennema and Sherman say, "Parents perceive mathematics to be more appropriate for boys than for girls, and by their actions parents offer more encouragement to boys than to girls to learn mathematics. Parents report buying more mathematical games for boys and offering more explicit reward and reinforcement to their sons to learn mathematics than to their daughters."

The attitudes of peers are another factor in females' perceptions of themselves as students of mathematics. In research in grades 6–12, Fennema and Sherman (1977a) report that males, more than females, consistently stereotyped mathematics as a male domain. The boys did not stereotype mathematics strongly but in each case did so significantly more than did girls. It seems plausible that especially during adolescence the feelings of classmates are influential in decisions and attitudes concerning mathematics.

Perhaps more influential than either parents or peers are teachers' attitudes about the study of mathematics by girls. "Teachers are the most important educational influences on students' learning of mathematics . . . While other educational agents may have influence on educational decisions, it is the day by day contact with teachers which is the main influence of the formal educational institution. Part of the teachers' influence is in the learners' development of sex role standards. These sex role standards include definitions of acceptable achievement in the various subject areas." (Fennema, 1977, pp. 114–15) Teachers may or may not use a textbook with sexist problems and illustrations. Regardless of how the book presents females as mathematics students, the teacher can point out societal sexual stereotypes. More important than the textbook is the manner in which the teacher presents the textbook. Teachers can easily make their students aware of stereotyping when it appears.



Teachers may also examine their interactions with boys and girls. In a review of research, Brophy and Good (1974) report that teachers generally have more interactions with boys than with girls. Teachers frequently have more positive contacts with boys, praise boys more often, and criticize boys more often than girls. Perhaps teachers need to be more aware of the quantity and quality of their contacts with female and male students. It may be that teacher-student contacts are a more important influence on the sex stereotyping of mathematics than are textbooks.

In conclusion, let us not stop at textbooks free of rigid sex stereotypes. More work needs to be done by teachers and researchers who understand the subtle influences on females both at home and at school. Schools can provide encouragement for females to study mathematics. This encouragement may be provided through working with *both* girls and boys. The attitudes of all people are important in the development of sex-role standards. Looking at textbooks is but an early step toward providing equity for females in mathematics.

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VIEWS OF FEMALES AND MALES IN MATHEMATICS CURRICULUM MATERIALS

Directions: Read the following mathematics problems. These were selected from typical children's mathematics texts and workbooks and modified for use here.

How are females and males portrayed in these problems?

1. Peggy ironed 4 skirts in 15 minutes. Then she ironed 3 blouses in 10 minutes. Which can she iron more quickly, skirts or blouses?

2. Leon walks 11 blocks to school in 15 minutes. Fred walks 13 blocks to school in 20 minutes. Who walks at the faster rate?

3. Betty is making cookies. The recipe she is using calls for 3/4 cup of sugar. How many cups of sugar should she use if she doubles the recipe?

4. Barbara bought a 5-pound bag of sugar. She used 3-1/4 pounds to make jelly. How many pounds of sugar were left?

5. Mary wants to buy some ribbon for a dress she is making. The ribbon costs 30¢ per yard. How much will 4-1/3 yards cost?

6. Don is picking apples. Each basket he fills holds 1-1/4 bushels. He has filled 2-1/2 baskets. How many bushels is that?

7. Angelo and Mike went fishing together. Angelo caught a fish weighing 4 pounds, 9 ounces. Mile caught a fish weighing 3 pounds, 11 ounces. How much heavier was Angelo's fish than Mike's fish?

8. David feeds his chickens 2-1/2 pounds of grain each day. At this rate, how many days will a 10-pound bag of grain last?

9. Carole has a piece of ribbon that is 17 inches long. She cuts it into 3 pieces of equal length. She wants to know how long each piece is. Which answer below would she use?

   5-2/3 inches 5 inches (2 left over)

10. Harry is pounding a nail through a board that is 3/4 inch thick. The nail is 1-3/8 inches long. How much of the nail will stick out the other side of the board when Harry is finished pounding?

NAME _____ DATE _____

CONTENT ANALYSIS: MATHEMATICS TEXTS*

	ILLUSTRATIONS		PROBLEMS	
	FEMALE	MALE	FEMALE	MALE
1. Representation (record frequency of male and female adults and of girls and boys)				
2. Occupation engaged in (list each occupation engaged in by a female or male)				
3. Activities participated in (list each activity participated in by an adult male or female and by a girl or boy)				
4. Sex-neutral/sex-biased language (note attempts to use sex-neutral language, and note sexist language)				

*Adapted from H. S. Kepner and L. R. Koehn, "Sex Roles in Mathematics: A Study of the Status of Sex Stereotypes in Elementary Mathematics Texts," The Arithmetic Teacher 24 (May 1977): 379-85. Used by permission.

CLASSROOM TASKS AND ACTIVITIES

The following classroom teacher quotes were developed by Annette Berson, a member of the TEAM staff.

1. "I need a strong boy to hold the flag for assembly."

2. "In your free time, the boys may complete their woodworking projects, and the girls may do their weaving."

3. "I hear whistling. It must be Steven."

4. "Mary, you look lovely today."

5. Heard in the gym: "Boys, carry the balls. Girls, take the jump ropes and hoops."

6. "Boys, there is an interesting story about the invention of a space phone on page 87. Girls, the story about Helen Keller will interest you."

7. "Which girls would like to join the sewing club?"

8. "I need a girl volunteer to water the flowers and plants in our room."

9. "We're going to form a committee to plan for our Spring Dance. The boys will be responsible for reserving a room, finding a band, and sending out publicity notices. Girls will take care of the food and decorations."

10. "Jane, please take the attendance."

11. "Robert, you are tall and strong; please open the windows."

12. Heard in nursery school: "Ann and Judy, clean up the doll corner. Adam, you may put away the blocks."

TEACHERS ARE IMPORTANT*

Characters

Millie Gorton, a young teacher

Sue Emery, an experienced teacher

Children in classes: Roberta, Theresa, Timothy, Maria, Boy, Girl

Scene 1: Teachers' room during lunch hour

Millie: Hi, Sue, how was your weekend?

Sue: It was really good. We went picknicking and hiking in the State Forest. What's new with you?

Millie: Not too much, really. I spent most of the weekend working. You know, I'm going to be observed in a few weeks, and I've been trying to get my class into the shape I'd like it to be in.

Sue: What's been happening in your class since that problem with Diane?

Millie: You know, I'm really pleased with the way things have been going in general. Most of the kids are quite involved in their projects. They seem to be progressing well in reading and writing. In fact, the only recent comments I've got from parents have been very positive. I've still got problems with math, though, and I've tried everything I can think of.

Sue: What do you mean, Millie?

Millie: Well, Sue, you know that I've never been good in math. The last math I studied was elementary algebra, which I hated. It was one of the few courses I ever got a C in, and the teacher was a real ogre. Well, ever since then I've stayed away from math. I hate balancing my checkbook, or even figuring out how much tip to leave for the waitress after lunch. With all those negative feelings, for me to try to teach math is a real problem. I know that my math feelings have kept me away from some things, and I'd really like my students to develop better attitudes, and really learn some math. (pause) So, I've tried some things and I've been looking around for some good lessons, but I'm not at all satisfied. Do you have any good tricks or advice?

---

*Script by Sheila Crowell, Elenor Rubin Denker, and Ellen Kolba.

Sue: Well, there are a few things that I do in my class which might work well for you. I've been teaching math to fourth graders for almost ten years now, and I think it's the subject I enjoy teaching most.

Millie: Really? I can't imagine anyone ever saying that!

Sue: Yes, really. It's the kind of subject where you can actually teach kids to <u>think and play at the same time</u>.

Millie: I know you're awfully busy these days, Sue, but if you have some time, I'd love to find out what you do with math, and maybe you could help me straighten up my act a little.

Sue: I'd love to, Millie. Then when it comes to music, perhaps you'd help me out--maybe we could even do some things with both classes. We could start out with our "Teaching Millie Math" campaign, then?

Millie: Oh, Sue, thank you so much. I'm ready to start whenever you are. What's the first step?

Sue: I think I'd like to start by watching what you are doing now. It will be easier for me to make suggestions then.

Millie: Well, I'll probably be embarrassed, but I think you are probably right; that's a good place to start. When do you want to come in?

Sue: I have a free period right now. Will you [illegible] teaching math at all this afternoon?

Millie: Yes, I wasn't planning on it for another hour or so, but it would be easy enough to change around. And you will then be seeing the "typical" lesson, because I'm doing all the things that haven't been going well.

<u>Scene 2</u>: Millie's class

(Bell rings)

Millie: (to class) Okay, boys and girls, lunch is over. Time to get to work. Today we're going to do our math now, and current events second. Please take out your books and check the board to see what your group is supposed to do. (rustle of books and papers; murmur of children's voices) Do you all see your assignments? Group 1, you are to do the problems on page 54. Group 2, the problems on page 67. Group 3, you have pages 81 and 82. Okay, everyone ready to begin? Remember, if you have any questions, please just raise your hand. (sound of pages turning, pencils scratching) Yes, Charlotte--all the problems. (more sounds of children writing, pages turning, some whispering) Roberta, do you have a question?

Roberta: I don't know what you do when you have two long numbers like these to add together.

Millie: There's an example at the top of the page. See, you just add the top and bottom number in each column together. Follow the example, Roberta. That's what it's there for. (again, sounds of classroom activity) Theresa, can I help you?

Theresa: Yes. I looked at the example, but I don't understand it. See, it shows these numbers written over in a different way. Like 576 is five hundreds, and seven tens, and six ones. And then you have to take away 239, and 239 is two hundreds, and three tens, and nine ones . . .

Millie: Yes, but you know how to do that. Remember, you rewrote all those numbers on the page just before this one.

Theresa: Yes, but that's not the problem. I mean, why do I have to do it that way? Why can't I just take away 239 from 576?

Millie: (sounding unsure of herself) Well . . . Theresa, that's the way they want you to do it on this page.

Theresa: Yeah, but . . .

Millie: Let's not waste any more time, Theresa. Just write each one out the way it is in the example. That's what the assignment is. (classroom sounds fade out)

Scene 3: Sue's class

Sue: Okay, class. You have your assignments for tomorrow. Now, don't forget to wear your white blouses and shirts for the assembly program in the morning. Have a good afternoon. So long now. (pause) Oh, hi, Millie, I'm glad you stopped by. Do you have a chance to talk now?

Millie: Oh, sure! What did you think?

Sue: Well, Millie, I have a few suggestions. First of all, I noticed you have a lot of exciting reading materials and language games in your room.

Millie: Yes, I told you that I was very pleased with the language arts program this year.

Sue: You know there are math games that the students could be using as well?

Millie: Really? I didn't know about those.

Sue: Oh, sure, you can buy them, or you can make some and the students could use them after a math lesson or during their free time. That can really help to change the tone of the math in your class.

Millie: What else could I do?

Sue: Well, when you work with your reading groups, you probably talk with them and ask questions before they start to read a story. But with math, you just told the class what problems to do. You didn't review or teach anything. And when the children don't get any particular direction and have to do everything on their own, including work up their own motivation, they're more apt to lose interest.

Millie: I guess you are right. I kind of hoped they would ask questions when they didn't understand, and I could work with them individually at that point.

Sue: Well, that sometimes works, but often the shy students get neglected that way. And, too, students don't always know what they don't know.

Millie: (thinking) I guess that's so.

Sue: Millie, do you remember that moment when Theresa asked you a question?

Millie: Yes.

Sue: You told her to follow the example. It almost seemed that you didn't really understand what the book wanted.

Millie: (embarrassed) You're right again, Sue. I thought I understood it when I looked over the problems to assign, but I didn't really read them carefully enough, and I couldn't remember why that problem should have been done in just that way.

Sue: Okay, so how about if we try these ideas for a few days, and let's see how it goes, and suppose I come back next week and we'll see if there are any other ideas or suggestions that I could offer you.

Millie: Sue, what a terrific idea! You know, I think I really can do some of those things. I'll try a group lesson on measuring. And I'll also try to get some math games into the class. Why don't you come a week from today after lunch and we'll see how far I've got.

Sue: I'd love to, Millie. See you then!

Scene 3: One week later, Millie's class

Millie: . . . and we can set up our aquarium today. The fish have arrived! (cheers from class) Julian and Lincoln, please get the aquarium from the closet. (pause) Be careful. Remember, it's heavy. Sara and Charlene, please make sure the aquarium is clean. Arlene, would you please put a mat on the table so the aquarium won't scratch it. (sounds of busyness) Now we're ready to add the water. How much water do you think a tank this size can hold? And how can we find that out? (boy and girl voices, eager to answer, saying, "Miss Gorton, I know") Timothy?

Timothy: You have to measure it.

Millie: All right, Timothy, would you please measure the aquarium.

Timothy: (pause) It's 30 centimeters high, 25 centimeters deep, and 50 centimeters long.

Millie: Maria, how many cubic centimeters is that?

Maria: (pause) That's 37 500 cubic centimeters.

Millie: That's right! Okay, we need 37 500 cubic centimeters of water.

Sue: (whispering) Millie, I have to leave now. This really looks terrific. Can you come up to my class in about half an hour? I think I'd like you to see my math lesson today.

Millie: Well, I think I can get someone to take the students to gym. I'll see you in half an hour.

Scene 4: Sue's class

Sue: That's a good way of finding the solution, Penny. Now let's take a look at the next problem on page 57. I'll read it out loud while you read it to yourselves. Remember to look and listen for the facts you need to find the solution. (sound of pages being turned) Okay, now. (reading) The boys and girls in Room 4 wanted to raise money for a class picnic. The boys washed cars at 75 cents a car and made six dollars. How many cars did they wash? The girls baked cupcakes and sold them for 50 cents a half dozen. They made six and a half dollars. How many cupcakes did they sell altogether? (speaking to class) You know, I'm so tired of reading problems where the boys always wash cars and build clubhouses and the girls just get to bake cupcakes and make dolls' clothing. Why don't we change this problem a bit?

Boy: Yeah, yeah, the girls did the easier job and make more money.

Girl: They always show the boys doing the things that are more fun. I'd rather wash a car. (sounds of a general but mild clamor starting)

Sue: All right, everyone. Suppose we just say that the students in Room 4 wanted to raise money. They divided into two teams. Team A washed cars, and Team B sold cupcakes. Everything else in the problem could stay the same. O.K.? (general sounds of assent) O.K. Now suppose we go on with the problem. Who can tell me what operation you will use to find the answer to this question? (classroom sounds fade out)

Scene 5: At the end of the day

Sue: Are you ready to leave, Millie? I'll give you a lift.

Millie: Oh, thank you, Sue.

Sue: How did things go after I left you with your aquarium?

Millie: Well, I was very pleased. The students seemed to enjoy learning about metrics that way. And I learned quite a bit myself.

Sue: I was really sorry I couldn't stay any longer. I'm not very familiar with the metric system myself.

Millie: You spent a lot of time talking about the language of the problems in your class. Do you really think it's that important?

Sue: Yes, Millie, I believe it's very important. So many math problems describe boys doing the running and the building and the girls doing things like cooking and sewing--or watching. The girls are often made to seem less competent than the boys.

Millie: You know, I guess I do that, too. I have to get over the feeling that math is "masculine."

Sue: Yes. In fact, the only suggestion I had about your aquarium lesson was that you had the boys doing the measuring, and that the girls were doing the cleaning.

Millie: Well, Sue, you know I always though that I was "liberated," but you are right. I do tend to keep the boys away from the housekeeping chores. I'll have to be more aware. But I must say that today's math lesson was one of the best lessons I've ever taught in any subject.

Sue: (laughing) I thought you couldn't imagine anyone ever saying anything like that.

Millie: Can you believe that I've changed this much? And I know that it will affect the attitudes of my students. I'm delighted, and I thank you for all your help. When that observation team comes next week, I bet I'll get all A's.

Sue: I bet you will, Millie. Let me know how it goes.

Millie: Bye, Sue, and thanks again.

Sue: Bye, Millie. And lots of good luck.

-- END --